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SELF-CENTERING PRESSURE ROLLER

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This application is a continuation-in-part of my copending application Ser. No. 326,970 filed November 29, 1963, now Patent No. 3,253,323 issued May 31, 1966.

In my prior application I have disclosed a pressure roller, e.g. as used for printing, embossing, calendering or conveying sheet material and the like, wherein a cylindrical sleeve removably surrounds a driven shaft with annular clearance, this clearance being occupied by a continuous clutch body which includes a plurality of inflatable cushion sections alternating with noninflatable sections by which the body is positively secured to the shaft. The cushion sections are inflatable by pressure fluid admitted via one or more conduits, preferably extending within the shaft itself, into the spaces between the shaft periphery and the inner body wall so that these sections bulge outwardly and engage the surrounding sleeve after the latter has been moved into telescopic relationship with the shaft in the deflated condition of the body. Advantageously, as also taught in my prior application, the deformable body is reinforced by a tubular insert of flexible but substantially inextensible material, such as a textile inlay of the type conventionally used in automotive tires, which is imbedded in the preferably elastomeric material of the body and which may be supplemented by imbedded clamping rings or the like holding the noninflatable body sections in firm contact with the shaft; the latter sections may also, alternatively or additionally, be adhesively bonded (e.g. by vulcanization) to the shaft or secured to it in some other convenient manner.

The arrangement just described affords satisfactory torque transmission between the shaft and the sleeve during operation and facilitates assembly and disassembly of the parts when the system is not in use. Thus, it permits the removal of the outer sleeve and its replacement by another sleeve of different external dimensions and/or markings whereby, in the case of a printing cylinder or embossing roller, quick changes can be made in the design to be reproduced. By the same token, a defective sleeve can be easily replaced.

Particularly in the case of relatively strong and/or uneven external pressures, however, the sleeve does not invariably retain its coaxial relationship with the driving shaft as the interposed inflatable supporting body undergoes eccentric deformation. The general object of my present invention is to provide means in such pressure roller for effectively resisting this deformation and minimizing any departure of the sleeve from its coaxial position.

This object is realized, in accordance with my present invention, by the provision of axially spaced ribs on the shaft to engage the noninflatable body sections at points whose distance from the shaft axis is greater than the shaft radius in the region of the inflatable cushion section but is less than the inner radius of the sleeve diminished by the thickness of the body in the region of the noninflatable sections so that the cushion sections, which in their inflated stage bulge out beyond the interleaved noninflated or shaft-engaging sections, can drop back into the spaces between the ribs, with inversion of their curvature, upon evacuation of the pressure fluid from

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these spaces. At the same time, the inextensible insert described in my prior application is given an undulating outline so as to have small-diameter portions imbedded in the noninflatable sections, the latter sections limiting the outward bulging of these cushion sections so as to resist a noncircular deformation of the inflated body, thereby tending to center the sleeve on the shaft.

Advantageously, in accordance with a further feature of my present invention, some of the cushion sections may be made heavier than others, i.e. their thickness as measured between the inextensible insert and the outer body surfaces may be increased, so that the insert is somewhat slacker in the region of these sections than in the remaining cushion sections whose thickness is reduced and whose outer diameter, in the fully inflated stage, substantially corresponds to the inner diameter of the sleeve. The heavier cushion sections, which I prefer to dispose approximately midway around the shaft, thus afford increased frictional coupling between the sleeve and the body while the reduced cushion sections constitute an almost rigid support for the extremities of the sleeve, thereby preventing its wobbling on the shaft.

The ribs engaging the noninflatable body sections may be annular and mutually separated or may constitute portions of a continuous helicoidal ridge. They could, in either case, form pairs flanking the noninflatable body sections so as positively to prevent any axial shifting of the body with reference to the shaft even in the absence of adhesive bonding.

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a longitudinal sectional view of an inflatable clutch body according to the invention, mounted on a shaft and shown in its inflated state but without a cooperating sleeve;

FIG. 2 is a view similar to FIG. 1, showing the associated sleeve in position; and

FIG. 3 is a fragmentary sectional view similar to FIGS. 1 and 2, illustrating a modification.

In FIGS. 1 and 2 I have shown a shaft **1** whose extremities *3a*, *3b* form reduced gudgeons and which is provided at axially spaced locations with a series of annular ribs **5** separated by zones **7** of smaller diameter. A fluid channel **6** extends axially within the shaft **1** and has a number of branch channels **6***a* opening into the spaces **7**.

A continuous tubular body **4**, of rubber or other elastomeric material, surrounds the ribbed portion of shaft **1** and is subdivided into annular cushion sections **9** alternating with noninflatable shaft-engaging sections **8** which are in all-around contact with respective ribs **5** and may be adhesively secured thereto, e.g. by vulcanization. Annular clamps **11**, imbedded in the material of body **4**, maintain the connecting sections **8** in close contact with the ribs **5** of the shaft.

A tubular insert in the form of a textile inlay **10** is also imbedded in body **4** and extends close to the inner periphery thereof, inside the clamping rings **11**. This insert **10** is of undulating profile and thus consists of small-diameter sections **10***a* alternating with large-diameter sections **10***b*, the respective diameters of these sections having been designated d and D. The thickness t of body **4**, measured from its outer periphery to the location of inlay **10**, is so chosen that the sum $D+2t$ is substantially equal to the inner diameter S of a rigid cylindrical sleeve **2** adapted to be shoved onto the body **4** in the deflated condition of the latter. At certain locations, specifically in the central region of shaft **1**, the cushion sections **9** are of a larger thickness T so that the fabric **10** in these sections is not stretched to its full diameter D when the body **4** is inflated against the sleeve **2** as shown in FIG. 2. Thus, this body will then include cushion sections **9***a*